



# Lilies at the Limit: Pollination Services and the Distribution of *Erythronium montanum*

Elinore J. Theobald and Dr. Janneke HilleRisLambers, Biology Department, University of Washington

## Importance

Unfortunately, many people have negative associations with bees. Between bee stings and bee allergies the little critters can be quite cruel. However, bees provide an essential ecosystem service: pollination. In the US alone, more than 150 food crops rely on animal pollination, totaling an estimated \$4 to \$7 billion in US agriculture annually. Pollinators are equally essential to Mount Rainier's ecosystems (Figure 1). Pollinators ensure the reproductive success of many flowering plant species and without pollination, plant communities would likely not persist. In the middle of summer, subalpine meadows glow with Lupine, Bistort, Aster, and Paintbrush (Figure 2) attracting not only pollinators but also more than one million human visitors yearly. The park relies on bees and other pollinators for their essential ecosystem services but their future is not certain.

## Status and Trends

The global climate is changing and there have been significant biological responses to this warming. For example, in England, the date of flowering is happening on average 4.5 days earlier in the spring now than it did in 1990 (Fitter and Fitter 2002) and species distributions are shifting both uphill and towards the poles at rates faster than previously thought (up to 11 meters in elevation gain per decade – Chen et al 2011). At Mount Rainier climate change could mean less winter snow accumulation, earlier snow melt, and warmer drier

summers. How will these changes affect plants and pollinators?



**Figure 1: Pollination is an Essential Ecosystem Service** – A flower-fly (Family Syrphidae) foraging for pollen on Avalanche Lily (*Erythronium montanum*). Pollinators (like this fly) rely on plants for food – either pollen or nectar – and plants rely on pollinators for reproduction. In the case of the Avalanche Lily, flowers will not set seed if not pollinated by insects.



**Figure 2: Wildflower Meadows Attract Many Visitors – Human and Insect** – This picture shows one of the many incredible views of the summit from a subalpine meadow. Each year more than one million human visitors come to Mount Rainier National Park, many of them for views like this one. Pollinator visits ensure that plants will set seed and ensure that meadows will continue to flower for generations to come.

Will plants and pollinators shift the timing of their life events (i.e., flowering and flying) synchronously in response to climate change? Will flowering plants shift their ranges if they rely on pollination to set seed? The impact of climate change on plant-pollinator interactions remains largely unknown, but to understand the full extent of the biological impacts of climate change, we must consider how climate change will impact interactions between species. My research is designed to ask: How will climate change affect plant-pollinator interactions in subalpine meadows on Mt. Rainier?

## Discussion

There are many ways in which climate change may affect plant-pollinator interactions. First, climate may asynchronously or disproportionately affect the timing of flowering and the timing of insect activity; and second, climate change may affect plant and insect distributions.

Preliminary data suggest that pollen transfer limits Avalanche Lily from reaching its reproductive potential at its upper elevational distribution. In contrast, flowers set fruit overall less frequently at the lower elevational distribution but not because they are limited by pollen transfer (Figure 4). This suggests that pollination services contribute to the geographic distribution of this species but only at one range margin. The implications of these findings suggest that as the climate warms, it is unlikely that Avalanche Lily will expand its range to higher elevations. In the coming summers we will continue to investigate the impacts of climate on plant-pollinator interactions within Mount Rainier National Park.

